Docket Number: C03-002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	**Davis, Jason et al.**		
Serial Number:	**10/625,201**	Group Art Unit:	**2624**
Filed:	**7/22/2003**	Examiner:	**Strege, John B.**

Title: **METHOD FOR PARTITIONING A PATTERN INTO OPTIMIZED SUB-PATTERNS**

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TRANSMITTAL TO SUBMIT TRANSLATION TO GERMAN PATENT REFERENCE CITED IN INFORMATION DISCLOSURE STATEMENT

Sir:

Please note the following translation is being submitted for the German patent reference, DE 4406020, cited in the attached Information Disclosure Statement. Applicant respectfully requests examiner to now consider said German patent DE 4406020 and submits the follow translated paragraphs relevant to the applicant's application.

On page 3 – 4 of cited German patent the relevant paragraphs begin with the last paragraph of column 3 and include all paragraphs through half of column 5 on page 5 – 6 of said patent. The translation is as follows:

It is not size-invariant, since the graph is only shifted, not scaled. It was assumed so far in the literature (Buhmann et aluminium, IJCNN II, 411-416, IEEE, San Diego, 1990) that with scaling of the graph, the filter coefficients must be inter- and/or extrapolated as well. Such a

procedure is cpu time consuming, since after each optimization step interpolation would be required. Furthermore it was assumed so far that the size determination would succeed only by a hierarchical procedure, which progresses from coarse to fine resolutions. The invention described here solves the task of the size-invariant recognition by a considerably simplified procedure.

-The search expenditure grows linearly with the number of stored objects. Furthermore the correct recognition becomes ever more difficult with increasing number of objects. Thus the employment in large data bases becomes problematic. The invention represented here describes a new procedure, the verification, which avoids the above disadvantages. Beyond that, this procedure can be combined particularly well with size-invariant recognition.

The procedures well-known as 'state of the art' exhibit a set of disadvantages and are not able not to satisfy in each regard. Therefore there is a constant need of improved procedures for the recognition of intrinsic distortable objects.

It was the task (goal) of the present invention to provide, compared to the well known state of the art techniques, an improved procedure for the recognition of objects. Thereby it was aspired to provide a possibility for the differentiation to the effect that different images of the same object (with differences in position, view and size of the object) are recognized as similar, while images of different objects are classified as dissimilar.

A further objective was to develop a technical application of this procedure as a person access control system that was based on an improved procedure for the recognition of faces. The task consists in particular in the ability to accomplish the verification of the access authorization, also at a large circle of entitled persons, fast and surely.

Surprisingly it was found that one can significantly improve the size-invariant object recognition simply by simultaniously connecting the Global Move with a Global Scale. This can be accomplished by moving the Graph as well as scaling it with a factor close to 1. Against expectations, an interpolation of the filter coefficients ist not necessary for a wide range if object sizes (from about 60% to 140% of the original size). Compared to currently available solutions, this provides an accelerated adaption to size changes, as it is of special importance for many applications.

The subject of the present invention is a procedure for the automated recognition of objects from pictures of these objects, whereby one extracts Gabor characteristics from a digital image with Gabor filters of different size and orientation. These Gabor characteristics are merged (combined) into a moveable, scaleable and distortable graph G.

For each of the stored graphs, the form and position of the graph G is optimized in such a way that the graph comparison function E takes optimal values. The location (determination, finding) of the optimal graph G for each stored graph is accomplished in two phases.

Phase 1

Selection of a random shift vector and scaling factor for the entire graph. The graph changed in that way in the new image is compared wirth the stored graphs by applying the graph comparsion function E, whereupon the links of the stored graph have been multiplied with the scaling factor before. The change of the graph will be accepted only if the new state has a more favorable value for E.

Phase 2

All links of the stored graph will be multiplied with the optimal scaling factor determined in Phase 1. Based on the optimal condition of the graph determined in Phase 1, single nodes of the graph will be shifted (local distortion), until an optimal irregular graph is found (Picture 2)

In a preferred way of execution of the present invention, in each optimization step of Phase 1, based on the current position and size of the graph, a randon shift of up to 3% of the image size and a simultaneous scaling of the graph of up to 10% of the graph's size is chosen. However, with the examined pictures, the procedure provides equally good results for a wide range of parameters.

With this form of execution, the correct scaling factors with an accuracy of +/- 2% are found for images that show stored objects shrunk by 75%. This was shown by experiments where 12 Gabor filters were used (4 equidistant orientations with 3 different sizes each, characterized by its optimal frequencies f which, starting at the fighest frequency of f = PI/2, following at distances of half (semi) octaves) . The 12-component Jets are arranged in a 7x10 graph and the image material are facial images of persons (128x128 pixels) with a white background, as

they are shown in [Lades'93] . Under these preconditions, the the optimal graph size (here 75% smaller) is retrieved with a reproducability of +/- 2% from various starting positions.

Examiner is welcome to contact the applicant should any questions arise regarding this German reference and/or the translated paragraphs

Respectfully submitted,

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